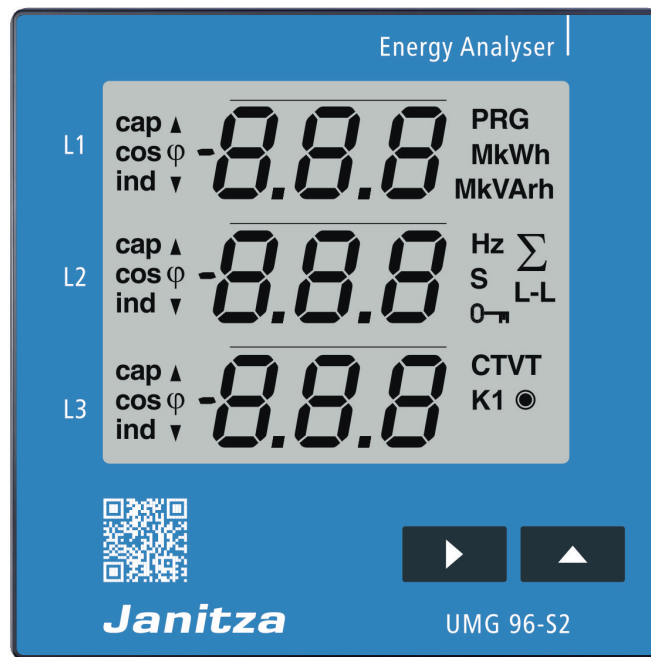


Energy Analyser UMG 96-S2

Modbus-address list
and Formulary



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Modbus

Modbus-Funktionen

Das UMG 96-S2 unterstützt als Slave folgende Modbus-Funktionen:

03 Read Holding Registers

Reads the binary contents of holding registers (4X references) in the slave.

04 Read Input Registers

Reads the binary contents of input registers (3X references) in the slave.

06 Preset Single Register

Presets a value into a single holding register (4X reference). When broadcast, the function presets the same register reference in all attached slaves.

16 (10Hex) Preset Multiple Registers

Presets values into a sequence of holding registers (4X references). When broadcast, the function presets the same register references in all attached slaves.

23 (17Hex) Read/Write 4X Registers

Performs a combination of one read and one write operation in a single Modbus transaction. The function can write new contents to a group of 4XXXX registers, and then return the contents of another group of 4XXXX registers. Broadcast is not supported.

Transfer parameters

The UMG 96-S2 supports the following transfer parameters:

| | |
|-----------------------|---------------------------|
| Baud rate | : 9600, 19200, 38400 Baud |
| Data bits | : 8 |
| Parity | : odd / even |
| Stop bits (UMG 96-S2) | : 1 or 2 |
| Stop bits external | : 1 or 2 |

Byte sequence

The data in the modbus address list can be called up in the

- Big-Endian (high-Byte before low-Byte) and in the
- Little-Endian (low-byte before high-byte)

format.

The addresses described in this address list supply the data in the „Big-Endian“ format.

If you require the data in the „Little-Endian“ format, you must add the value 32768 to the address.

Update rate

The modbus register addresses are updated every 200 ms.

Measured values

- Measured values in the **short** format do not take into account the set transformer ratio, i.e. these measured values have to be multiplied by the corresponding transformer factor!
- Measured values in **float or integer format** take into account the corresponding transformer factors!

Number formats

| typee | Size | Minimum | Maximum |
|--------|--------|-----------|--------------|
| char | 8 bit | 0 | 255 |
| byte | 8 bit | -128 | 127 |
| short | 16 bit | -2^{15} | $2^{15} - 1$ |
| ushort | 16 bit | 0 | $2^{16} - 1$ |
| int | 32 bit | -2^{31} | $2^{31} - 1$ |
| uint | 32 bit | 0 | $2^{32} - 1$ |
| long64 | 64 bit | -2^{63} | $2^{63} - 1$ |
| float | 32 bit | IEEE 754 | IEEE 754 |
| double | 64 bit | IEEE 754 | IEEE 754 |

Symbols and definitions

| | |
|------|---|
| N | Total number of sample points per period (For example, in a period of 20 ms) |
| k | Sample value or number of samples per period ($0 \leq k < N$) |
| p | Number or identification of the phase conductor ($p = 1, 2$ oder 3) |
| ipk | Sample value k of the current of the phase conductor p |
| upNk | Sample value k of the neutral voltage of the phase conductor p |
| Pp | Real power of the phase conductor p |

Explanations of the measured values

- **Note: Depending on the instrument type, not all listed measured value types are available!**

Measured value

- A measured value is a effective value which is formed over a period (measuring window) of 200ms.
- A measuring window is 10 periods in the 50 Hz network and 12 periods in the 60 Hz network.
- A measuring window has a start time and an end time.
- The resolution between the start time and end time is approximately 2 ns.
- The accuracy of the start time and end time depends on the accuracy of the internal clock. (typically +- 1 minute/month)
- In order to improve the accuracy of the internal clock, it is recommended that the clock in the device is compared with a time service and reset.

Mean value of measured value

- For each measured value, a sliding mean value is calculated over the selected averaging time.
- The mean value is calculated every 200 ms.
- You can take the possible averaging times from the table.

| n | Mean time / seconds | n | Mean time / seconds |
|---|---------------------|---|---------------------|
| 0 | 5 | 5 | 300 |
| 1 | 10 | 6 | 480 |
| 2 | 15 | 7 | 600 |
| 3 | 30 | 8 | 900 |
| 4 | 60 | | |

Max. value of measured value

- The *max. value of the measured value* is the largest measured value which has occurred since the last deletion.

Min. value of measured value

- The *min. value of the measured value* is the lowest measured value which has occurred since the last deletion.

Max. value of mean value

- The *max. value of the mean value* is the largest mean value which has occurred since the last deletion.

Nominal current, voltage, frequency

- The limit values for events and transients are set by the nominal value in percentage.

Nominal current I_{rated}

- The I_{rated} is the nominal current of the transformers and is required for calculation of the K-factor.

Peak value negative

- Highest negative sampling value from the last 200 ms measuring window..

Peak value positive

- Highest positive sampling value from the last 200 ms measuring window.

Crest factor

- The crest factor describes the relation between the peak value and effective value of a periodic quantity. It serves as a characteristic value for general description of the curve form of a periodic quantity. The distortion factor is another example of a quantity for characterization of the difference from the pure sinusoidal form.
- Example: A sinusoidal change voltage with an effective value of 230 V has a peak value of approx. 325 V. The crest factor is then $325 \text{ V} / 230 \text{ V} = 1.414$.

Effective value of the current for phase conductor p

$$I_p = \sqrt{\frac{1}{N} \cdot \sum_{k=0}^{N-1} i_{pk}^2}$$

Effective value of neutral conductor current

$$I_N = \sqrt{\frac{1}{N} \cdot \sum_{k=0}^{N-1} (i_{1k} + i_{2k} + i_{3k})^2}$$

Effective voltage L-N

$$U_{pN} = \sqrt{\frac{1}{N} \cdot \sum_{k=0}^{N-1} u_{pNk}^2}$$

Effective voltage L-L

$$U_{pg} = \sqrt{\frac{1}{N} \cdot \sum_{k=0}^{N-1} (u_{gNk} - u_{pNk})^2}$$

Star connection voltage (vectorial)

$$U_{\text{Sternpunktspannung}} = U_{1ms} + U_{2ms} + U_{3ms}$$

Real power for phase conductor

$$P_p = \frac{1}{N} \cdot \sum_{k=0}^{N-1} (u_{pNk} \times i_{pk})$$

Apparent power for phase conductor

- Unsigned

$$S_p = U_{pN} \cdot I_p$$

Total apparent power (arithmetic) S_A

- Unsigned

$$S_A = S_1 + S_2 + S_3$$

Peak demand P_{\max}

- T = Periodic time
- t_n = n-th interval time
- P_n = n-th Power measurement value
- N = Number of measuring intervals in the period T

$$P_{\max} = \max \left(P_{\max}; \frac{1}{T} \sum_{n=1}^N (t_n \cdot P_n) \right)$$

Order number of harmonics

xxx[0] = mains frequency (50 Hz/60 Hz)
 xxx[1] = 2nd harmonic (100 Hz/120 Hz)
 xxx[2] = 3rd harmonic (150 Hz/180 Hz)
 etc.

THD

- THD (Total Harmonic Distortion) is the distortion factor and provides the relation of the harmonic parts of an oscillation to the mains frequency.

Distortion factor for the voltage

- M = 40 (UMG 604, UMG 508, UMG 96RM)
- M = 50 (UMG 605, UMG 511)
- fund corresponds to n=1

$$THD_U = \frac{1}{|U_{fund}|} \sqrt{\sum_{n=2}^M |U_{n.Harm}|^2}$$

Distortion factor for the current

- M = 40 (UMG 604, UMG 508, UMG 96RM)
- M = 50 (UMG 605, UMG 511)
- fund corresponds to n=1

$$THD_I = \frac{1}{|I_{fund}|} \sqrt{\sum_{n=2}^M |I_{n.Harm}|^2}$$

ZHD

- THD for the interharmonics.
- Is calculated in the product series UMG 511 and UMG 605.

Interharmonics

- Sinusoidal oscillations, which frequencies are not a multiple integer of the mains frequency.
- Is calculated in the product series and UMG 511 UMG 605.
- Calculation and measurement methods in accordance with the DIN EN 61000-4-30.
- The order number of inter harmonics corresponds to the order number of the next smallest harmonic. For example, between the 3rd and 4th harmonic of the 3rd inter harmonics.

TDD (I)

- TDD Total demand distortion, harmonic current distortion in % of maximum demand load current
- IL = Maximum demand load current
- M = 40 (UMG 604, UMG 508, UMG 96RM)
- M = 50 (UMG 605, UMG 511)

$$TDD = \frac{1}{I_L} \sqrt{\sum_{n=2}^M I_n^2} \times 100\%$$

Ripple control signal U (EN61000-4-30)

The ripple control signal U is a voltage (200 ms measured value) which is measured at a carrier frequency specified by the user. Only frequencies beneath 3 kHz are observed.

Ripple control signal I

The ripple control signal I is a current (200 ms measured value) which is measured at a carrier frequency specified by the user. Only frequencies beneath 3 kHz are observed.

Positive sequence-negative sequence-zero sequence

- The extent of a voltage or current imbalance in a three-phase system is identified using the positive sequence, negative sequence and zero sequence components.
- The balance of the rotation current system strived for in normal operation is disturbed by the unsymmetrical loads, errors and equipment.
- A three-phase system is called symmetric, when the three phase conductor voltages and currents are the same size and are displaced against each other by 120°. If one or both conditions are not fulfilled, the system is described as un-symmetrical. By calculating the symmetrical components consisting of the positive sequence, negative sequence and zero sequence, the simplified analysis of an imbalanced error is possible in a rotary current system..
- Imbalance is a feature of the network quality for the limits specified in international norms (EN 50160 for example).

Positive sequence

$$U_{Mit} = \frac{1}{3} \left| U_{L1,fund} + U_{L2,fund} \cdot e^{j\frac{2\pi}{3}} + U_{L3,fund} \cdot e^{j\frac{4\pi}{3}} \right|$$

Negative sequence

$$U_{Geg} = \frac{1}{3} \left| U_{L1,fund} + U_{L2,fund} \cdot e^{-j\frac{2\pi}{3}} + U_{L3,fund} \cdot e^{-j\frac{4\pi}{3}} \right|$$

Zero sequence

$$U_{Nullsystem} = \frac{1}{3} \left| U_{L1,fund} + U_{L2,fund} + U_{L3,fund} \right|$$

A zero component can only occur if a sum current can flow back through the main conductor.

Voltage imbalance

$$Unsymmetrie = \frac{U_{Geg}}{U_{Mit}}$$

Under difference U (EN61000-4-30)

$$U_{unter} = \frac{U_{din} - \sqrt{\frac{\sum_{i=1}^n U_{rms-unter,i}^2}{n}}}{U_{din}} [\%]$$

Under difference I

$$I_{unter} = \frac{I_{Nennstrom} - \sqrt{\frac{\sum_{i=1}^n I_{rms-unter,i}^2}{n}}}{I_{Nennstrom}} [\%]$$

K-factor

- The K-factor describes the increase of the eddy current losses when loaded with harmonics. For a sinusoidal load on the transformer, the K-factor =1. The larger the K-factor, the heavier a transformer can be loaded with harmonics without overheating.

Power Factor (vectorial) - Lambda

- The power factor is unsigned.

$$PF_A = \frac{|P|}{S_A}$$

CosPhi - Fundamental Power Factor

- Only the mains frequency part is used for calculation of the cosphi.
- CosPhi sign:
 - = for the supply of real power
 - + = for obtaining real power

$$PF_1 = \cos(\varphi) = \frac{P_1}{S_1}$$

CosPhi total

- CosPhi sign:
 - = for the supply of real power
 - + = for obtaining real power

$$\cos(\varphi)_{Sum_3} = \frac{P_{1_{fund}} + P_{2_{fund}} + P_{3_{fund}}}{\sqrt{(P_{1_{fund}} + P_{2_{fund}} + P_{3_{fund}})^2 + (Q_{1_{fund}} + Q_{2_{fund}} + Q_{3_{fund}})^2}}$$

$$\cos(\varphi)_{Sum_4} = \frac{P_{1_{fund}} + P_{2_{fund}} + P_{3_{fund}} + P_{4_{fund}}}{\sqrt{(P_{1_{fund}} + P_{2_{fund}} + P_{3_{fund}} + P_{4_{fund}})^2 + (Q_{1_{fund}} + Q_{2_{fund}} + Q_{3_{fund}} + Q_{4_{fund}})^2}}$$

Phase Angle Phi

- The phase angle between current and voltage of the external conductor p is calculated according to DIN EN 61557-12 and displayed.
- The sign of the phase angle corresponding to the sign of the reactive power.

Mains frequency power factor

The mains frequency power factor is the power factor of the mains frequency and is calculated using the fourier analysis (FFT). The voltage and current must not be sinusoidal. All in the device calculated reactive power are resulting of fundamental reactive power.

Power factor sign

- Sign $Q = +1$ for φ_p in the range $0^\circ \dots 180^\circ$ (inductive)
- Sign $Q = -1$ for φ_p in the range $180^\circ \dots 360^\circ$ (capacitive)

$$\text{Vorzeichen } Q(\varphi_p) = +1 \text{ falls } \varphi_p \in [0^\circ - 180^\circ]$$

$$\text{Vorzeichen } Q(\varphi_p) = -1 \text{ falls } \varphi_p \in [180^\circ - 360^\circ]$$

Reactive power for phase conductor p

- Reactive power of the mains frequency.

$$Q_{fund p} = \text{Vorzeichen } Q(\varphi_p) \cdot \sqrt{S_{fund p}^2 - P_{fund p}^2}$$

Total reactive power

- Reactive power of the mains frequency.

$$Q_V = Q_1 + Q_2 + Q_3$$

Distortion power factor

- The distortion power factor is the power factor of all mains frequencies and is calculated using the fourier analysis (FFT).
- The apparent power „S” contains all fundamental harmonics and all harmonic rates up to the M-th harmonic.
- The effective power „P” contains all fundamental harmonics and all harmonic rates up to the M-th harmonic.
- M = 50 (UMG 605, UMG 605-PRO, UMG 511, UMG 512-PRO)

$$D = \sqrt{S^2 - P^2 - Q_{fund}^2}$$

Reactive energy per phase

$$E_{r_{L1}} = \int Q_{L1}(t) \cdot \Delta t$$

Reactive energy per phase, inductive

$$E_{r(ind)_{L1}} = \int Q_{L1}(t) \cdot \Delta t \quad \text{für } Q_{L1}(t) > 0$$

Reactive energy per phase, capacitive

$$E_{r(cap)_{L1}} = \int Q_{L1}(t) \cdot \Delta t \quad \text{für } Q_{L1}(t) < 0$$

Reactive energy, sum L1-L3

$$E_{r_{L1,L2,L3}} = \int (Q_{L1}(t) + Q_{L2}(t) + Q_{L3}(t)) \cdot \Delta t$$

Reactive energy, sum L1-L3, inductive

$$E_{r(ind)_{L1,L2,L3}} = \int (Q_{L1}(t) + Q_{L2}(t) + Q_{L3}(t)) \cdot \Delta t$$

für $(Q_{L1}(t) + Q_{L2}(t) + Q_{L3}(t)) > 0$

Reactive energy, sum L1-L3, capacitive

$$E_{r(cap)_{L1,L2,L3}} = \int (Q_{L1}(t) + Q_{L2}(t) + Q_{L3}(t)) \cdot \Delta t$$

für $(Q_{L1}(t) + Q_{L2}(t) + Q_{L3}(t)) < 0$

Address list

Frequently required readings

| Address | Format | RD/WR | Unit | Note |
|---------|--------|-------|------|--|
| 19000 | float | RD | V | voltage L1-N |
| 19002 | float | RD | V | voltage L2-N |
| 19004 | float | RD | V | voltage L3-N |
| 19006 | float | RD | V | voltage L1-L2 |
| 19008 | float | RD | V | voltage L2-L3 |
| 19010 | float | RD | V | voltage L3-L1 |
| 19012 | float | RD | A | current L1 |
| 19014 | float | RD | A | current L2 |
| 19016 | float | RD | A | current L3 |
| 19018 | float | RD | A | current sum (calculated current in N) |
| 19020 | float | RD | W | active power L1 |
| 19022 | float | RD | W | active power L2 |
| 19024 | float | RD | W | active power L3 |
| 19026 | float | RD | W | active power sum |
| 19028 | float | RD | VA | apparent power L1 |
| 19030 | float | RD | VA | apparent power L2 |
| 19032 | float | RD | VA | apparent power L3 |
| 19034 | float | RD | VA | apparent power sum |
| 19036 | float | RD | var | reactive power L1 |
| 19038 | float | RD | var | reactive power L2 |
| 19040 | float | RD | var | reactive power L3 |
| 19042 | float | RD | var | reactive power sum |
| 19044 | float | RD | - | power factor L1 |
| 19046 | float | RD | - | power factor L2 |
| 19048 | float | RD | - | power factor L3 |
| 19050 | float | RD | Hz | measured frequency |
| 19052 | int | RD | - | rotation field; 1=right (clockwise), 0=none, -1=left (counter clockwise) |
| 19054 | float | RD | Wh | active energy L1 |
| 19056 | float | RD | Wh | active energy L2 |
| 19058 | float | RD | Wh | active energy L3 |
| 19060 | float | RD | Wh | active energy sum |
| 19062 | float | RD | Wh | active energy L1, consumed |
| 19064 | float | RD | Wh | active energy L2, consumed |
| 19066 | float | RD | Wh | active energy L3, consumed |
| 19068 | float | RD | Wh | active energy sum, consumed |
| 19070 | float | RD | Wh | active energy L1, delivered |
| 19072 | float | RD | Wh | active energy L2, delivered |
| 19074 | float | RD | Wh | active energy L3, delivered |
| 19076 | float | RD | Wh | active energy sum, delivered |
| 19078 | float | RD | VAh | apparent energy L1 |
| 19080 | float | RD | VAh | apparent energy L2 |
| 19082 | float | RD | VAh | apparent energy L3 |
| 19084 | float | RD | VAh | apparent energy sum |
| 19086 | float | RD | varh | reactive energy L1 |
| 19088 | float | RD | varh | reactive energy L2 |
| 19090 | float | RD | varh | reactive energy L3 |
| 19092 | float | RD | varh | reactive energy sum |
| 19094 | float | RD | varh | reactive energy, inductive, L1 |
| 19096 | float | RD | varh | reactive energy, inductive, L2 |
| 19098 | float | RD | varh | reactive energy, inductive, L3 |
| 19100 | float | RD | varh | reactive energy, inductive, sum |
| 19102 | float | RD | varh | reactive energy, capacitive, L1 |
| 19104 | float | RD | varh | reactive energy, capacitive, L2 |
| 19106 | float | RD | varh | reactive energy, capacitive, L3 |
| 19108 | float | RD | varh | reactive energy, capacitive, sum |

| Address | Format | RD/WR | Unit | Note |
|---------|--------|-------|------|-----------------------|
| 19110 | float | RD | % | harmonic, THD, U L1-N |
| 19112 | float | RD | % | harmonic, THD, U L2-N |
| 19114 | float | RD | % | harmonic, THD, U L3-N |
| 19116 | float | RD | % | harmonic, THD, I L1 |
| 19118 | float | RD | % | harmonic, THD, I L2 |
| 19120 | float | RD | % | harmonic, THD, I L3 |

Parameter

| Address | Format | RD/WR | Note |
|---------|--------|-------|---|
| 0 | short | RD/WR | device address (0...255*) |
| 1 | short | RD/WR | baudrate (0=9.6 kbps; 1=19.200 kbps; 2=38.400 kbps) |
| 2 | short | RD/WR | framing (0=1 stopbit; 1=2 stopbit; 2=even; 3=odd) |
| 10 | float | RD/WR | current transformer, primary (in A: 0...1000000**) |
| 12 | float | RD/WR | current transformer, secondary (in A: 1,5) |
| 14 | float | RD/WR | voltage transformer, primary (in V: 0...1000000**) |
| 16 | float | RD/WR | voltage transformer, secondary (in V: 100, 400) |
| 35 | short | RD/WR | display contrast (0=low ... 9=high) |
| 37 | short | RD/WR | display profile (0=profil 1; 1 = profile 2; 2=profile 3) |
| 38 | short | RD/WR | rotation profile (0=profil 1; 1 = profile 2; 2=profile 3) |
| 39 | short | RD/WR | rotation time (0=off; 1...60 sec.) |
| 40 | short | RD/WR | averaging time, I (in sec: 0=5; 1=10; 2=30; 3=60; 4=300; 5=480; 6=900; 7=1800; 8=3600) |
| 41 | short | RD/WR | averaging time, P (in sec: 0=5; 1=10; 2=30; 3=60; 4=300; 5=480; 6=900; 7=1800; 8=3600) |
| 42 | short | RD/WR | averaging time, U (in sec: 0=5; 1=10; 2=30; 3=60; 4=300; 5=480; 6=900; 7=1800; 8=3600) |
| 43 | short | RD/WR | current threshold (in A: 0...0.2) |
| 45 | short | RD/WR | voltage threshold (in V: 0...32) |
| 50 | short | RD/WR | password |
| 100 | short | RD/WR | dig. output 1 (0=P; 1=Q; 2=S; 3=off) |
| 102 | float | RD/WR | puls valence, output 1 (in e.g. imp/kWh: -1000000...1000000) |
| 106 | short | RD/WR | min. pulse duration (in ms: 10...1000) |
| 506 | short | RD/WR | delete min. and max. values (0, 1) |
| 507 | short | RD/WR | delete energy (0,1) |
| 600 | int | RD/WR | overrange (0, 0x0000007F) |
| 618 | short | RD/WR | tariff, active energy (0, 1=tariff 1; 2=tariff 2, 3=tariff 1+2) |
| 619 | short | RD/WR | tariff, active energy, consumed (0, 1=tariff 1; 2=tariff 2, 3=tariff 1+2) |
| 620 | short | RD/WR | tariff, active energy, delivered (0, 1=tariff 1; 2=tariff 2, 3=tariff 1+2) |
| 621 | short | RD/WR | tariff, reactive energy (0, 1=tariff 1; 2=tariff 2, 3=tariff 1+2) |
| 622 | short | RD/WR | tariff, reactive energy, inductive (0, 1=tariff 1; 2=tariff 2, 3=tariff 1+2) |
| 623 | short | RD/WR | tariff, reactive energy, capacitive (0, 1=tariff 1; 2=tariff 2, 3=tariff 1+2) |
| 624 | short | RD/WR | tariff, apparent energy (0, 1=tariff 1; 2=tariff 2, 3=tariff 1+2) |

Address list

Measured values, type float

| Address | Format | RD/WR | Note |
|---------|--------|-------|---|
| 1000 | float | RD | voltage L1-N |
| 1002 | float | RD | voltage L2-N |
| 1004 | float | RD | voltage L3-N |
| 1006 | float | RD | voltage L1-L2 |
| 1008 | float | RD | voltage L2-L3 |
| 1010 | float | RD | voltage L3-L1 |
| 1012 | float | RD | power factor L1 |
| 1014 | float | RD | power factor L2 |
| 1016 | float | RD | power factor L3 |
| 1018 | float | RD | power factor sum3=Psum3/Ssum3 |
| 1020 | float | RD | THD voltage L1 |
| 1022 | float | RD | THD voltage L2 |
| 1024 | float | RD | THD voltage L3 |
| 1026 | float | RD | THD current L1 |
| 1028 | float | RD | THD current L2 |
| 1030 | float | RD | THD current L3 |
| 1032 | float | RD | cos(phi) L1 |
| 1034 | float | RD | cos(phi) L2 |
| 1036 | float | RD | cos(phi) L3 |
| 1038 | float | RD | cos(phi) sum |
| 1040 | float | RD | phi L1 (in °) |
| 1042 | float | RD | phi L2 (in °) |
| 1044 | float | RD | phi L3 (in °) |
| 1046 | float | RD | current L1 |
| 1048 | float | RD | current L2 |
| 1050 | float | RD | current L3 |
| 1052 | float | RD | current sum (calculated current in N) |
| 1054 | float | RD | active power L1 |
| 1056 | float | RD | active power L2 |
| 1058 | float | RD | active power L3 |
| 1060 | float | RD | active power sum |
| 1062 | float | RD | reactive power L1 |
| 1064 | float | RD | reactive power L2 |
| 1066 | float | RD | reactive power L3 |
| 1068 | float | RD | reactive power sum |
| 1070 | float | RD | apparent power L1 |
| 1072 | float | RD | apparent power L2 |
| 1074 | float | RD | apparent power L3 |
| 1076 | float | RD | apparent power sum |
| 1078 | float | RD | active power of the fundamental oscillation L1 |
| 1080 | float | RD | active power of the fundamental oscillation L2 |
| 1082 | float | RD | active power of the fundamental oscillation L3 |
| 1084 | float | RD | active power of the fundamental oscillation sum |
| 1086 | float | RD | frequency |
| 1088 | int | RD | rotation field (0 = no, 1 = clockwise, -1 = counterclockwise) |

Mean values, type float

| Address | Format | RD/WR | Note |
|---------|--------|-------|--|
| 2000 | float | RD | mean value voltage L1 |
| 2002 | float | RD | mean value voltage L2 |
| 2004 | float | RD | mean value voltage L3 |
| 2006 | float | RD | mean value voltage L1-L2 |
| 2008 | float | RD | mean value voltage L2-L3 |
| 2010 | float | RD | mean value voltage L3-L1 |
| 2012 | float | RD | mean value current L1 |
| 2014 | float | RD | mean value current L2 |
| 2016 | float | RD | mean value current L3 |
| 2018 | float | RD | mean value current sum |
| 2020 | float | RD | mean value active power L1 |
| 2022 | float | RD | mean value active power L2 |
| 2024 | float | RD | mean value active power L3 |
| 2026 | float | RD | mean value active power sum |
| 2028 | float | RD | mean value reactive power L1 |
| 2030 | float | RD | mean value reactive power L2 |
| 2032 | float | RD | mean value reactive power L3 |
| 2034 | float | RD | mean value reactive power sum |
| 2036 | float | RD | mean value apparent power L1 |
| 2038 | float | RD | mean value apparent power L2 |
| 2040 | float | RD | mean value apparent power L3 |
| 2042 | float | RD | mean value apparent power sum |
| 2044 | float | RD | mean value active power, fundamental oscillation L1 |
| 2046 | float | RD | mean value active power, fundamental oscillation L2 |
| 2048 | float | RD | mean value active power, fundamental oscillation L3 |
| 2050 | float | RD | mean value active power, fundamental oscillation sum |
| 2052 | float | RD | mean value frequency |

Minimum values, type float

| Address | Format | RD/WR | Note |
|----------------|---------------|--------------|--------------------------|
| 2204 | float | RD | min. value voltage L1 |
| 2206 | float | RD | min. value voltage L2 |
| 2208 | float | RD | min. value voltage L3 |
| 2210 | float | RD | min. value voltage L1-L2 |
| 2212 | float | RD | min. value voltage L2-L3 |
| 2214 | float | RD | min. value voltage L3-L1 |
| 2216 | float | RD | min. value, frequency |

Maximum values, type float

| Address | Format | RD/WR | Note |
|---------|--------|-------|--|
| 2054 | float | RD | max. value, voltage L1-N |
| 2056 | float | RD | max. value, voltage L2-N |
| 2058 | float | RD | max. value, voltage L3-N |
| 2060 | float | RD | max. value, voltage L1-L2 |
| 2062 | float | RD | max. value, voltage L2-L3 |
| 2064 | float | RD | max. value, voltage L3-L1 |
| 2162 | float | RD | max. value current L1 |
| 2164 | float | RD | max. value current L2 |
| 2166 | float | RD | max. value current L3 |
| 2168 | float | RD | max. value current sum |
| 2170 | float | RD | max. value active power L1 |
| 2172 | float | RD | max. value active power L2 |
| 2174 | float | RD | max. value active power L3 |
| 2176 | float | RD | max. value active power sum |
| 2178 | float | RD | max. value reactive power L1 |
| 2180 | float | RD | max. value reactive power L2 |
| 2182 | float | RD | max. value reactive power L3 |
| 2184 | float | RD | max. value reactive power sum |
| 2186 | float | RD | max. value apparent power L1 |
| 2188 | float | RD | max. value apparent power L2 |
| 2190 | float | RD | max. value apparent power L3 |
| 2192 | float | RD | max. value apparent power sum |
| 2194 | float | RD | max. value active power, fundamental frequency L1 |
| 2196 | float | RD | max. value active power, fundamental frequency L2 |
| 2198 | float | RD | max. value active power, fundamental frequency L3 |
| 2200 | float | RD | max. value active power, fundamental frequency sum |
| 2202 | float | RD | max. value frequency |

Maximum values of mean values, type float

| Address | Format | RD/WR | Note |
|----------------|---------------|--------------|-------------------------------------|
| 2218 | float | RD | max. of mean value current L1 |
| 2220 | float | RD | max. of mean value current L2 |
| 2222 | float | RD | max. of mean value current L3 |
| 2224 | float | RD | max. of mean value current sum |
| 2226 | float | RD | max. of mean value active power L1 |
| 2228 | float | RD | max. of mean value active power L2 |
| 2230 | float | RD | max. of mean value active power L3 |
| 2232 | float | RD | max. of mean value active power sum |

Energy values, type float

| Address | Format | RD/WR | Note |
|---------|--------|-------|---|
| 4000 | float | RD | active energy L1 |
| 4002 | float | RD | active energy L2 |
| 4004 | float | RD | active energy L3 |
| 4006 | float | RD | active energy sum |
| 4008 | float | RD | active energy L1, consumed |
| 4010 | float | RD | active energy L2, consumed |
| 4012 | float | RD | active energy L3, consumed |
| 4014 | float | RD | active energy sum, consumed |
| 4016 | float | RD | active energy L1, delivered |
| 4018 | float | RD | active energy L2, delivered |
| 4020 | float | RD | active energy L3, delivered |
| 4022 | float | RD | active energy sum, delivered |
| 4024 | float | RD | reactive energy L1 |
| 4026 | float | RD | reactive energy L2 |
| 4028 | float | RD | reactive energy L3 |
| 4030 | float | RD | reactive energy sum |
| 4032 | float | RD | reactive energy L1, inductive |
| 4034 | float | RD | reactive energy L2, inductive |
| 4036 | float | RD | reactive energy L3, inductive |
| 4038 | float | RD | reactive energy sum, inductive |
| 4040 | float | RD | reactive energy L1, capacitive |
| 4042 | float | RD | reactive energy L2, capacitive |
| 4044 | float | RD | reactive energy L3, capacitive |
| 4046 | float | RD | reactive energy sum, capacitive |
| 4048 | float | RD | apparent energy L1 |
| 4050 | float | RD | apparent energy L2 |
| 4052 | float | RD | apparent energy L3 |
| 4054 | float | RD | apparent energy sum |
| 4056 | float | RD | active energy L1 , tariff 1 |
| 4058 | float | RD | active energy L2, tariff 1 |
| 4060 | float | RD | active energy L3, tariff 1 |
| 4062 | float | RD | active energy sum, tariff 1 |
| 4064 | float | RD | active energy L1, consumed, tariff 1 |
| 4066 | float | RD | active energy L2, consumed, tariff 1 |
| 4068 | float | RD | active energy L3, consumed, tariff 1 |
| 4070 | float | RD | active energy sum, consumed, tariff 1 |
| 4072 | float | RD | active energy L1, delivered, tariff 1 |
| 4074 | float | RD | active energy L2, delivered, tariff 1 |
| 4076 | float | RD | active energy L3, delivered, tariff 1 |
| 4078 | float | RD | active energy sum, delivered, tariff 1 |
| 4080 | float | RD | reactive energy L1, tariff 1 |
| 4082 | float | RD | reactive energy L2, tariff 1 |
| 4084 | float | RD | reactive energy L3, tariff 1 |
| 4086 | float | RD | reactive energy sum, tariff 1 |
| 4088 | float | RD | reactive energy L1, inductive, tariff 1 |
| 4090 | float | RD | reactive energy L2, inductive, tariff 1 |
| 4092 | float | RD | reactive energy L3, inductive, tariff 1 |
| 4094 | float | RD | reactive energy sum, inductive, tariff 1 |
| 4096 | float | RD | reactive energy L1, capacitive, tariff 1 |
| 4098 | float | RD | reactive energy L2, capacitive, tariff 1 |
| 4100 | float | RD | reactive energy L3, capacitive, tariff 1 |
| 4102 | float | RD | reactive energy sum, capacitive, tariff 1 |
| 4104 | float | RD | apparent energy L1, tariff 1 |
| 4106 | float | RD | apparent energy L2, tariff 1 |
| 4108 | float | RD | apparent energy L3, tariff 1 |
| 4110 | float | RD | apparent energy sum, tariff 1 |
| 4112 | float | RD | active energy L1 , tariff 2 |
| 4114 | float | RD | active energy L2, tariff 2 |
| 4116 | float | RD | active energy L3, tariff 2 |

| Address | Format | RD/WR | Note |
|---------|--------|-------|---|
| 4118 | float | RD | active energy sum, tariff 2 |
| 4120 | float | RD | active energy L1, consumed, tariff 2 |
| 4122 | float | RD | active energy L2, consumed, tariff 2 |
| 4124 | float | RD | active energy L3, consumed, tariff 2 |
| 4126 | float | RD | active energy sum, consumed, tariff 2 |
| 4128 | float | RD | active energy L1, delivered, tariff 2 |
| 4130 | float | RD | active energy L2, delivered, tariff 2 |
| 4132 | float | RD | active energy L3, delivered, tariff 2 |
| 4134 | float | RD | active energy sum, delivered, tariff 2 |
| 4136 | float | RD | reactive energy L1, tariff 2 |
| 4138 | float | RD | reactive energy L2, tariff 2 |
| 4140 | float | RD | reactive energy L3, tariff 2 |
| 4142 | float | RD | reactive energy sum, tariff 2 |
| 4144 | float | RD | reactive energy L1, inductive, tariff 2 |
| 4146 | float | RD | reactive energy L2, inductive, tariff 2 |
| 4148 | float | RD | reactive energy L3, inductive, tariff 2 |
| 4150 | float | RD | reactive energy sum, inductive, tariff 2 |
| 4152 | float | RD | reactive energy L1, capacitive, tariff 2 |
| 4154 | float | RD | reactive energy L2, capacitive, tariff 2 |
| 4156 | float | RD | reactive energy L3, capacitive, tariff 2 |
| 4158 | float | RD | reactive energy sum, capacitive, tariff 2 |
| 4160 | float | RD | apparent energy L1, tariff 2 |
| 4162 | float | RD | apparent energy L2, tariff 2 |
| 4164 | float | RD | apparent energy L3, tariff 2 |
| 4166 | float | RD | apparent energy sum, tariff 2 |

Energy values, type double

| Address | Format | RD/WR | Note |
|---------|--------|-------|---|
| 3000 | double | RD | active energy L1 |
| 3004 | double | RD | active energy L2 |
| 3008 | double | RD | active energy L3 |
| 3012 | double | RD | active energy sum |
| 3016 | double | RD | active energy L1, consumed |
| 3020 | double | RD | active energy L2, consumed |
| 3024 | double | RD | active energy L3, consumed |
| 3028 | double | RD | active energy sum, consumed |
| 3032 | double | RD | active energy L1, delivered |
| 3036 | double | RD | active energy L2, delivered |
| 3040 | double | RD | active energy L3, delivered |
| 3044 | double | RD | active energy sum, delivered |
| 3048 | double | RD | reactive energy L1 |
| 3052 | double | RD | reactive energy L2 |
| 3056 | double | RD | reactive energy L3 |
| 3060 | double | RD | reactive energy sum |
| 3064 | double | RD | reactive energy L1, inductive |
| 3068 | double | RD | reactive energy L2, inductive |
| 3072 | double | RD | reactive energy L3, inductive |
| 3076 | double | RD | reactive energy sum, inductive |
| 3080 | double | RD | reactive energy L1, capacitive |
| 3084 | double | RD | reactive energy L2, capacitive |
| 3088 | double | RD | reactive energy L3, capacitive |
| 3092 | double | RD | reactive energy sum, capacitive |
| 3096 | double | RD | apparent energy L1 |
| 3100 | double | RD | apparent energy L2 |
| 3104 | double | RD | apparent energy L3 |
| 3108 | double | RD | apparent energy sum |
| 3112 | double | RD | active energy L1 , tariff 1 |
| 3116 | double | RD | active energy L2, tariff 1 |
| 3120 | double | RD | active energy L3, tariff 1 |
| 3124 | double | RD | active energy sum, tariff 1 |
| 3128 | double | RD | active energy L1, consumed, tariff 1 |
| 3132 | double | RD | active energy L2, consumed, tariff 1 |
| 3136 | double | RD | active energy L3, consumed, tariff 1 |
| 3140 | double | RD | active energy sum, consumed, tariff 1 |
| 3144 | double | RD | active energy L1, delivered, tariff 1 |
| 3148 | double | RD | active energy L2, delivered, tariff 1 |
| 3152 | double | RD | active energy L3, delivered, tariff 1 |
| 3156 | double | RD | active energy sum, delivered, tariff 1 |
| 3160 | double | RD | reactive energy L1, tariff 1 |
| 3164 | double | RD | reactive energy L2, tariff 1 |
| 3168 | double | RD | reactive energy L3, tariff 1 |
| 3172 | double | RD | reactive energy sum, tariff 1 |
| 3176 | double | RD | reactive energy L1, inductive, tariff 1 |
| 3180 | double | RD | reactive energy L2, inductive, tariff 1 |
| 3184 | double | RD | reactive energy L3, inductive, tariff 1 |
| 3188 | double | RD | reactive energy sum, inductive, tariff 1 |
| 3192 | double | RD | reactive energy L1, capacitive, tariff 1 |
| 3196 | double | RD | reactive energy L2, capacitive, tariff 1 |
| 3200 | double | RD | reactive energy L3, capacitive, tariff 1 |
| 3204 | double | RD | reactive energy sum, capacitive, tariff 1 |
| 3208 | double | RD | apparent energy L1, tariff 1 |
| 3212 | double | RD | apparent energy L2, tariff 1 |
| 3216 | double | RD | apparent energy L3, tariff 1 |
| 3220 | double | RD | apparent energy sum, tariff 1 |
| 3224 | double | RD | active energy L1 , tariff 2 |
| 3228 | double | RD | active energy L2, tariff 2 |
| 3232 | double | RD | active energy L3, tariff 2 |

| Address | Format | RD/WR | Note |
|---------|--------|-------|---|
| 3236 | double | RD | active energy sum, tariff 2 |
| 3240 | double | RD | active energy L1, consumed, tariff 2 |
| 3244 | double | RD | active energy L2, consumed, tariff 2 |
| 3248 | double | RD | active energy L3, consumed, tariff 2 |
| 3252 | double | RD | active energy sum, consumed, tariff 2 |
| 3256 | double | RD | active energy L1, delivered, tariff 2 |
| 3260 | double | RD | active energy L2, delivered, tariff 2 |
| 3264 | double | RD | active energy L3, delivered, tariff 2 |
| 3268 | double | RD | active energy sum, delivered, tariff 2 |
| 3272 | double | RD | reactive energy L1, tariff 2 |
| 3276 | double | RD | reactive energy L2, tariff 2 |
| 3280 | double | RD | reactive energy L3, tariff 2 |
| 3284 | double | RD | reactive energy sum, tariff 2 |
| 3288 | double | RD | reactive energy L1, inductive, tariff 2 |
| 3292 | double | RD | reactive energy L2, inductive, tariff 2 |
| 3296 | double | RD | reactive energy L3, inductive, tariff 2 |
| 3300 | double | RD | reactive energy sum, inductive, tariff 2 |
| 3304 | double | RD | reactive energy L1, capacitive, tariff 2 |
| 3308 | double | RD | reactive energy L2, capacitive, tariff 2 |
| 3312 | double | RD | reactive energy L3, capacitive, tariff 2 |
| 3316 | double | RD | reactive energy sum, capacitive, tariff 2 |
| 3320 | double | RD | apparent energy L1, tariff 2 |
| 3324 | double | RD | apparent energy L2, tariff 2 |
| 3328 | double | RD | apparent energy L3, tariff 2 |
| 3332 | double | RD | apparent energy sum, tariff 2 |

Fourier analysis

Measured values, type float, fourier analysis

| Address | Format | RD/WR | Note |
|---------|--------|-------|-------------------------|
| 1090 | float | RD | 1. harmonic voltage L1 |
| 1092 | float | RD | 3. harmonic voltage L1 |
| 1094 | float | RD | 5. harmonic voltage L1 |
| 1096 | float | RD | 7. harmonic voltage L1 |
| 1098 | float | RD | 9. harmonic voltage L1 |
| 1100 | float | RD | 11. harmonic voltage L1 |
| 1102 | float | RD | 13. harmonic voltage L1 |
| 1104 | float | RD | 15. harmonic voltage L1 |
| 1106 | float | RD | 1. harmonic voltage L2 |
| 1108 | float | RD | 3. harmonic voltage L2 |
| 1110 | float | RD | 5. harmonic voltage L2 |
| 1112 | float | RD | 7. harmonic voltage L2 |
| 1114 | float | RD | 9. harmonic voltage L2 |
| 1116 | float | RD | 11. harmonic voltage L2 |
| 1118 | float | RD | 13. harmonic voltage L2 |
| 1120 | float | RD | 15. harmonic voltage L2 |
| 1122 | float | RD | 1. harmonic voltage L3 |
| 1124 | float | RD | 3. harmonic voltage L3 |
| 1126 | float | RD | 5. harmonic voltage L3 |
| 1128 | float | RD | 7. harmonic voltage L3 |
| 1130 | float | RD | 9. harmonic voltage L3 |
| 1132 | float | RD | 11. harmonic voltage L3 |
| 1134 | float | RD | 13. harmonic voltage L3 |
| 1136 | float | RD | 15. harmonic voltage L3 |
| 1138 | float | RD | 1. harmonic current L1 |
| 1140 | float | RD | 3. harmonic current L1 |
| 1142 | float | RD | 5. harmonic current L1 |
| 1144 | float | RD | 7. harmonic current L1 |
| 1146 | float | RD | 9. harmonic current L1 |
| 1148 | float | RD | 11. harmonic current L1 |
| 1150 | float | RD | 13. harmonic current L1 |
| 1152 | float | RD | 15. harmonic current L1 |
| 1154 | float | RD | 1. harmonic current L2 |
| 1156 | float | RD | 3. harmonic current L2 |
| 1158 | float | RD | 5. harmonic current L2 |
| 1160 | float | RD | 7. harmonic current L2 |
| 1162 | float | RD | 9. harmonic current L2 |
| 1164 | float | RD | 11. harmonic current L2 |
| 1166 | float | RD | 13. harmonic current L2 |
| 1168 | float | RD | 15. harmonic current L2 |
| 1170 | float | RD | 1. harmonic current L3 |
| 1172 | float | RD | 3. harmonic current L3 |
| 1174 | float | RD | 5. harmonic current L3 |
| 1176 | float | RD | 7. harmonic current L3 |
| 1178 | float | RD | 9. harmonic current L3 |
| 1180 | float | RD | 11. harmonic current L3 |
| 1182 | float | RD | 13. harmonic current L3 |
| 1184 | float | RD | 15. harmonic current L3 |

Maximum values, type float, fourier analysis

| Address | Format | RD/WR | Note |
|---------|--------|-------|-------------------------------------|
| 2066 | float | RD | max. value, 1. harmonic voltage L1 |
| 2068 | float | RD | max. value, 3. harmonic voltage L1 |
| 2070 | float | RD | max. value, 5. harmonic voltage L1 |
| 2072 | float | RD | max. value, 7. harmonic voltage L1 |
| 2074 | float | RD | max. value, 9. harmonic voltage L1 |
| 2076 | float | RD | max. value, 11. harmonic voltage L1 |
| 2078 | float | RD | max. value, 13. harmonic voltage L1 |
| 2080 | float | RD | max. value, 15. harmonic voltage L1 |
| 2082 | float | RD | max. value, 1. harmonic voltage L2 |
| 2084 | float | RD | max. value, 3. harmonic voltage L2 |
| 2086 | float | RD | max. value, 5. harmonic voltage L2 |
| 2088 | float | RD | max. value, 7. harmonic voltage L2 |
| 2090 | float | RD | max. value, 9. harmonic voltage L2 |
| 2092 | float | RD | max. value, 11. harmonic voltage L2 |
| 2094 | float | RD | max. value, 13. harmonic voltage L2 |
| 2096 | float | RD | max. value, 15. harmonic voltage L2 |
| 2098 | float | RD | max. value, 1. harmonic voltage L3 |
| 2100 | float | RD | max. value, 3. harmonic voltage L3 |
| 2102 | float | RD | max. value, 5. harmonic voltage L3 |
| 2104 | float | RD | max. value, 7. harmonic voltage L3 |
| 2106 | float | RD | max. value, 9. harmonic voltage L3 |
| 2108 | float | RD | max. value, 11. harmonic voltage L3 |
| 2110 | float | RD | max. value, 13. harmonic voltage L3 |
| 2112 | float | RD | max. value, 15. harmonic voltage L3 |
| 2114 | float | RD | max. value, 1. harmonic current L1 |
| 2116 | float | RD | max. value, 3. harmonic current L1 |
| 2118 | float | RD | max. value, 5. harmonic current L1 |
| 2120 | float | RD | max. value, 7. harmonic current L1 |
| 2122 | float | RD | max. value, 9. harmonic current L1 |
| 2124 | float | RD | max. value, 11. harmonic current L1 |
| 2126 | float | RD | max. value, 13. harmonic current L1 |
| 2128 | float | RD | max. value, 15. harmonic current L1 |
| 2130 | float | RD | max. value, 1. harmonic current L2 |
| 2132 | float | RD | max. value, 3. harmonic current L2 |
| 2134 | float | RD | max. value, 5. harmonic current L2 |
| 2136 | float | RD | max. value, 7. harmonic current L2 |
| 2138 | float | RD | max. value, 9. harmonic current L2 |
| 2140 | float | RD | max. value, 11. harmonic current L2 |
| 2142 | float | RD | max. value, 13. harmonic current L2 |
| 2144 | float | RD | max. value, 15. harmonic current L2 |
| 2146 | float | RD | max. value, 1. harmonic current L3 |
| 2148 | float | RD | max. value, 3. harmonic current L3 |
| 2150 | float | RD | max. value, 5. harmonic current L3 |
| 2152 | float | RD | max. value, 7. harmonic current L3 |
| 2154 | float | RD | max. value, 9. harmonic current L3 |
| 2156 | float | RD | max. value, 11. harmonic current L3 |
| 2158 | float | RD | max. value, 13. harmonic current L3 |
| 2160 | float | RD | max. value, 15. harmonic current L3 |